

# *Mastoidectomy in Children – Selection of Surgical Technique and Preoperative Preparation*

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## **Introduction**

This chapter highlights important aspects concerning surgical indications and preoperative preparation related to surgical management of otitis media in children.

The concept of chronic otitis media (COM) has been widely discussed (**Chart 1**). Some authors advocate that the definition of chronicity should be related to the histopathological changes that occur in the recovering mucosa of the middle ear.

**Chart 1.** Classification of otitis media and complications according to Bluestone

Otitis media without effusion
Acute otitis media
Otitis media with effusion
Eustachian tube dysfunction *
Tympanic membrane atelectasia *
Complications and intratemporal sequels
Hearing loss
Tympanic membrane perforation *
Suppurative chronic otitis media *
Cholesteatoma*
Retraction pocket *
Adhesive otitis media *
Tympanosclerosis*
Discontinuity of ossicle fixation *
Mastoiditis
Petrositis
Labyrinthitis
Facial palsy
Cholesterol granuloma
Eczematous infectious dermatitis
Intracranial complications
Meningitis
Extradural abscess
Subdural empyema
Focal encephalitis
Cerebral abscess
Lateral sinus thrombosis
Hydrocephalus

Note: The diseases marked with an asterisk are the ones most commonly classified as chronic otitis media.

From a clinical perspective, the presence of irreversible structural changes of the middle ear and tympanic membrane (TM) would better describe this type of otitis. Taking into account surgical and prognostic factors, COM may be classified as non-cholesteatomatous otitis media (NCCOM) and cholesteatomatous otitis media (CCOM).

In Pediatric Otorhinolaryngology, COM complications are closely related to the longevity of children, in addition to directly influencing the indications of surgical treatment.

### **Clinical manifestations of COM**

Hearing loss associated with otorrhea is the main clinical manifestation of chronic otitis media. The main causes of hearing loss in children of developing countries are associated with COM. In general, the hearing loss is conductive, with an air-bone gap of about 30dB, depending on the size and site of the TM perforation. If there is discontinuity of the ossicular chain, the air-bone gap may be as high as 50dB. In some cases of cholesteatomatous COM, we observe a “collumelar effect” caused by the cholesteatoma that works as an ossicle or sometimes replaces the destroyed ossicular chain. Sensorineural hearing loss can result following an episode of suppurative labyrinthitis or the transfer of ototoxic substances through the round window. Otorrhea is another frequent sign of COM. Otorrhea may result from contaminated water passing through a TM perforation or as a result of the infectious process of a middle ear/mastoid infection, or as an extension of an infectious or inflammatory process in the nose such a rhinosinusitis or allergic rhinitis. Fetid otorrhea refractory to clinical treatment should lead professionals to suspect of the presence of cholesteatoma.

Otalgia, dizziness, fever, marked headache and facial palsy are infrequent manifestations of these diseases and indicate possible complications.

### **Selection of Mastoidectomy – Peculiarities in Pediatric Otorhinolaryngology**

The main challenge of ear surgery in children is the fact that they will have to live with the surgical outcome for many decades. Moreover, in our time, communication skills are one of the main elements that will determine the professional future of such children. Finally, the severity of COM complications and high rate of cholesteatoma recurrence in children are also extremely important factors.

Ideally, the operative ear would be free from disease, with good hearing and fit for swimming activities. However, meeting all such outcomes may be impossible. Traditionally, otologists treated CCOM by employing **radical mastoidectomy** or **modified radical mastoidectomy** to promote a safe ear. Later on, the emphasis of the surgical technique shifted to preventing the ear destruction caused by surgery and preserving the hearing function, which resulted in the development of **canal wall up technique (simple mastoidectomy)**. Some surgeons choose the surgical technique based on individual issues that are related with the child's ear, even if second look surgeries become necessary. In developing countries, social-economic conditions that prevent appropriate postoperative follow-up make surgeons prefer less conservative techniques. Many techniques have been developed to reconstruct the ear after radical mastoidectomy, using different materials to promote appropriate hearing, imitating the normal ear.

A balance can be attempted between more radical surgical techniques (**radical mastoidectomy, canal wall down**), which sacrifice hearing to promote a safe ear, and techniques that prevent an open cavity and protect hearing, but have higher risks of recurrence or relapse. In cases of extensive disease that prevents canal wall up procedure, we can try the **canal wall window** procedure. This technique blocks the small window in the canal wall, from the epitympanus, promoting better visualization and more space to move the surgical instruments. As a result, we can obtain a normal anatomical ear with the possibility of good hearing. In such cases, second look surgeries may be required.

### **Preoperative Assessment**

The most important aspect in the evaluation of a patient with COM is to perform careful otoscopy using an otoscope, microscope or video-otoscope. Good light is essential to successful otoscopy. Secretions should be aspirated and acute processes have to be treated with antibiotics and steroids, enabling the detection of details that were hidden by the inflammatory process. Details such as the size and location of any TM perforation, if marginal or central, presence of tympanic edges or not, are important elements for surgical technique decision-making. Marginal or attical perforations, as well as the presence of epithelial crusts, make us suspect cholesteatoma and can require a surgical approach to the epitympanum and mastoid. Perforations of anterior quadrants may require modification of the tympanoplasty technique: inappropriate visualization of anterior region of the TM may require a canal-plasty. For ethicolegal issues, it is recommended to photo-document any TM abnormalities.

The presence of active and profuse otorrhea, abundant inflammatory tissue, polyps and granulation tissue that hinder visualization may impair the surgical act by increasing bleeding and enhancing the likelihood of iatrogenic outcomes. Therefore, we try as much as possible to perform preoperative clinical control to reach a dry ear or one that has fewer active infectious or inflammatory processes. In general, the use of drops or antibiotic or steroid ointments associated with aspiration and cleaning is important to achieving such an end. Systemic drugs are reserved for cases refractory to topical drugs.

Audiometric assessment is mandatory in the preoperative setting. The presence of an air-bone gap greater than 30 dB suggests erosion of the ossicular chain. Sensorineural hearing loss, especially if it includes auditory fluctuation and dizziness, can be caused by labyrinthine fistula, normally located on the lateral semicircular canal and region of the cochlear window niches. Documentation through audiometric study is also important for ethical-legal reasons.

Computed tomography scan (CT), without contrast, is always indicated in cases of cholesteatoma and complications of chronic otitis. A CT scan is also indicated in cases of NCCOM that require surgery of the mastoid and epitympanum. The gold standard for the diagnosis of COM is otomicroscopy; CT scan is considered an important complementary tool to define the management strategy, thus reducing the risks of peri-operative complications.

The diagnosis and treatment of nasosinal inflammatory pathologies and adenoiditis

should be performed before middle ear surgery to reduce the likelihood of post-surgical failure.

Eustachian tube function is another important factor that interferes with the prognosis of these patients. The Eustachian tube function may be indirectly checked by parameters such as status of contralateral ear checked by otoscopy and tympanometry, level of pneumatization of mastoid at CT scan (mastoid acts as a middle ear pressure gauge), frequency of isolated otorrhea, or evaluation of nasosinal processes. However, Eustachian tube dysfunction is not an absolute contraindication to the procedure. Excision of granulation or adhesions close to the tympanic ostium of the Eustachian tube, in addition to treatment of nasopharyngeal and nasosinal abnormalities, may promote appropriate closing of the Eustachian tube, contributing to better surgical results.

The minimum age in which to perform these procedures in children is still controversial. Immune immaturity, Eustachian tube dysfunction in pre-school children associated with technical difficulties owing to the small size of the external auditory canal, are factors that contribute to decreased surgical success in children. Tympanoplasty and mastoidectomy, preferentially, should be performed after the 7 years of age. However, younger age should not be considered an absolute contraindication to these procedures. In cases in which the inflammatory process cannot be clinically controlled, the surgical approach of the middle ear is indicated, regardless of the child's age.

### **Recommended readings**

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